Small Business Innovation Research/Small Business Tech Transfer

Advanced Propeller Flow Control for Increased Propulsive Efficiency, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

An important mission for NASA is the development of revolutionary flight concepts and technology. The development of unmanned air vehicles (UAVs), the resurgence of general aviation, and growing interest in environmentally conscious, all-electric, emissionless aircraft have brought about a renewed interest in propeller design. Overall, since the propeller's golden age during the WWII era, very little has changed in propeller design. Computers have automated the design processes, but the basic design methodology, from an aerodynamic point of view has changed very little. Strides have been made in acoustics and multidisciplinary optimization (MDO), but the basic aerodynamic design and performance of the subsonic propeller has basically remained unchanged. The explosion of UAVs and a need for more efficient designs allowing greater payload, range, and loiter times have taken UAVs from simple cut-and-try designs to sophisticated, aerodynamically efficient systems. An area as of yet not fully exploited by this class of aircraft, is that of propeller efficiency. Most smaller UAVs and micro-UAVs simply use off-the-shelf radio control propellers, while moderate size UAVs rely on propellers designed using classical blade element theory or those derived for general aviation aircraft. While these propellers provide industry acceptable levels of thrust for a given torque, the majority of propellers suffer some form of flow separation. The extent of flow separation can range from small areas in cruise regions of the flight envelope, to large areas during climb and wind milling. Significant propeller performance gains in the form of increased thrust and reduced torque can be obtained by eliminating these separated regions across the flight envelope. A simple, efficient, and robust flow control technique is proposed to eliminate these separated regions and provide a marked increase in propeller performance and vehicle propulsive performance.

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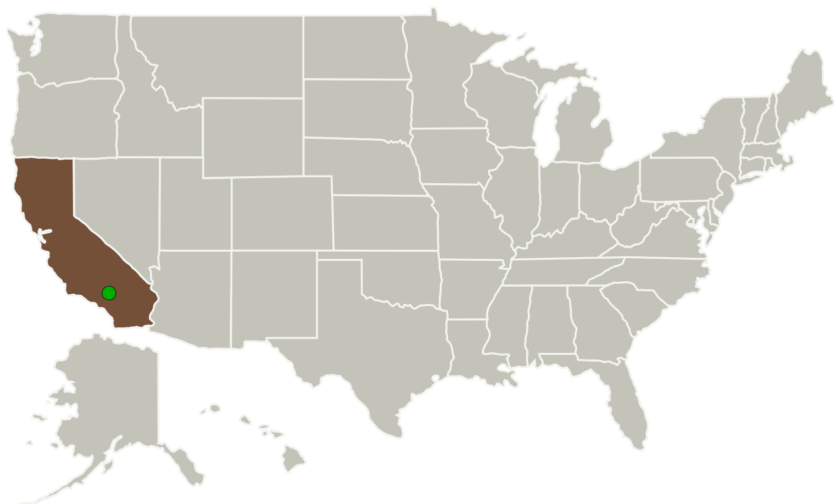
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Rolling Hills Research Corporation	Lead Organization	Industry	El Segundo, California
Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations
California

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/138795)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Rolling Hills Research Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

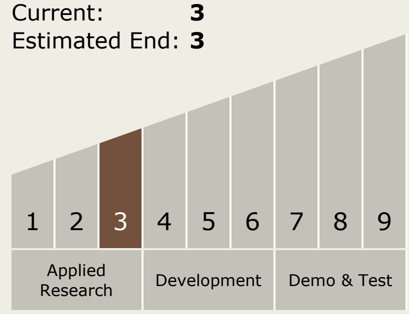
Carlos Torrez

Principal Investigator:

Michael Kerho

Technology Maturity (TRL)

Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  └ TX15.1 Aerosciences
    └ TX15.1.5 Propulsion Flowpath and Interactions

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System